REMARKS

In response to the Office Action dated May 2, 2007, Applicant has amended claims 11, 15 and 16. In addition, Applicant files herewith a Declaration of Phillip Kauffman describing a series of experiments showing the change in aerosol size distribution and concentration in response to ionization of the atmosphere using the antenna of the invention. In addition, the Declaration includes a selection of articles by third parties indicating the acceptance of the effects of aerosol size distribution and concentration on climate and/or weather modification. No new matter is added. The amendments to the claims are for purposes of clarity.

As an initial matter, Applicant asks that the finality of the rejection be removed. The rejection under 35 USC §101 and 35 USC §112, first paragraph for lack of a creditable utility is not based on amendments made by Applicant and was not present in the last Office Action against the same claims. Similarly, the rejection for lack of enablement relates to a portion of the claims that were original. In addition, the rejections under 35 USC § 103 are based on different art than the previous Office Action. Applicant disagrees with the Examiner and considers that the amendments to the claims did not necessitate these new rejections as the art is not dirrected to the features that were amended. As such, Applicant respectfully requests that the Examiner withdraw the finality of the rejection and enter the present amendment.

In response to the rejections of claim 1, 2, 4-10, 13 and 19 under 35 USC §101 and 35 USC §112, first paragraph for lack of a creditable utility, Applicant respectfully disagrees with the Examiner. As a way of ending any argument concerning whether credible utility exists, Applicant files herewith the Declaration of , the inventor, Phillip Kauffman, describing a series of scientific experiments using the antenna of the claimed invention. Briefly, the Declaration describes two sets of experiments, both showing the effect of the ionizing antenna on aerosol size distribution and concentration in the atmosphere. As shown in the articles previously presented and those attached to the Declaration, there is a well established and credible relationship between the number and size of aerosols in the atmosphere at a particular location and climate and weather.

The first experiment described in the Declaration shows a series of measurements made

by a specially equiped airplane that can measure the number and size of aerosols over different locations. Measurements were made with the ionization antenna of the invention powered with positive charge, negative charge and turned off. As is evident from Chart A of the Declaration, there is a substantial difference in aerosol counts if the antenna is in a positive or negative mode as compared with the antenna not operating. Thus, it is clear that the use of this antenna causes the requisite modification in aerosol size distribution and concentration when turned on.

The second experiment used the same airplane but was across a broader area, comparing the area where the ionization antenna modified the aerosols in the atmosphere to locations at a greater distance from the antenna. As is evidient from Chart B, there is a substantial difference in the number of aerosols in areas of the atmosphere where the antenna has produced ionization versus areas where the antenna is not operative.

These two experiments clearly show that the use of the ionization antenna of the invention clearly modifies the aerosol size distribution in a localized area. The articles previously presented, and, in particular, the articles atttached to the Declaration, make the requisite link between aerosols and weather and climate. As such, it is clear that the ionization antenna of the present invention can modify climate and weather. This is not related to thunderstorms but a fundamental change in the size and number of aerosols in the atmosphere.

With respect to the rejections to claims 11-13, 16 and 19 on the basis of lack of enablement because of the term "images", this has been rendered moot by the amendment to claims 11 and 16.

With respect to all of the objections under 35 USC §103, Applicant respectfully disagrees with the interpretation place by the Examiner on the primary reference, the Baldwin U.S. Patent No. 1,617,788. Baldwin is not related to climate or weather modification in any way; in contrast, it is directed to the protection against charge build-up to prevent fire. This is not a charged antenna to broadcast ions and modify weather. This is merely a passive system that is shaped to keep discharge of ions away from fire prone structures. The only reason for using Baldwin against the present invention is hindsight.

Fowler Patent No. 5,694,286 is also not a weather modification device nor is it an

antenna capable of modifying the climate. Fowler is merely a device to protect towers against lightening strikes. Fowler uses a low voltage (48 volt) battery to put negative ions about the tower to provent lightening strikes. There is no broadcasting of ions to modify the atmosphere and change the climate.

Thus, since neither Baldwin nor Fowler are even directed at the problem of the present invention nor do they describe the claimed apparatus or methods, this combination does not render obvious the present invention.

Similarly, none of the other references cited by the Exsminer cure the deficiencies of Fowler or Baldwin. The Howe, Guichard and van Horn patents merely discuss minor aspects of antennas without having anything to do with the fundemental aspect of the present invention; a device and method of modifying weather. Applicant believes that since the Examiner has taken the position that there is no credible utility (a position that is clearly erroneous in light of the Declaration and articles filed herewith), he is ignoring the differences between the fundemental aspecgts of the present invention and the cited art.

Thus, there is a difference in kind between all the cited references and the present invention in terms of the type of antenna and the output from the antenna. The claimed antenna is powered to a level that it broadcasts out a stream of ions and modfies the atmosphere. None of the cited references do this.

In light of the foregoing, Applicant considers that the claims, as amended, are in condition for allowance. Prompt notification of allowance is requested.

Respectfully submitted,

Date: July 31, 2007

Name: Ralph A. Loren
Registration No.: 29,325
Customer No.: 29933
Edwards Angell Palmer & Dodge LLP
P.O. Box 55874
Boston, MA 02205
Tel. (617) 239-0100

Express Mail Label No.: EV 970 590 927 US
Date of Deposit: July 31, 2007

Atty. Docket No.: 214218/2002 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:	Phillip Kauffman	Examiner:	Scott Allen Bauer
Serial No.:	10/719,565		
Filed:	November 20, 2003	Group Art Unit:	2836
Entitled:	Ionization Antenna		
		Conf. No.:	3550

CERTIFICATE OF MAILING UNDER 37 CFR 1.10

I hereby certify that the paper (and any paper or fee referred to as being enclosed) is being deposited with the United States Postal Service using Express Mail to Addressee Service, under 37 C.F.R. Section 1.10, **Express Mail Label No. EV 970 590 927 US** on this date July 31, 2007, postage prepaid, in an envelope addressed to Mail Stop: AF, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Bernadette Fallon
Name of Person Mailing Paper

Bernadette Fallon
Signature of Person Mailing Paper

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Declaration of Phillip Kauffman

I, Phillip Kauffman, declare as follows:

1. I am the named inventor on United States Patent Application Serial No. 10/719,565, entitled "Ionization Antenna" (the "'565 application").

2. I am also president of Ionogenics, Inc., a company engaged in experimentation in weather and climate modification using ionization antenna such as are described

and claimed in the '565 application.

3. The operation of the ionization antenna as described and claimed in the '565 application produces consistently observable differences in atmospheric particle (or aerosol) size distribution in a local area.

4. The difference in aerosol levels is significant because the scientific community unequivocally accepts the premise that atmospheric particle (or aerosol) counts, concentration and distribution are factors in effecting modifications in weather and/or climate.

5. The scientific foundations of ionization are documented in the numerous peer reviewed research papers and articles, wherein it is widely accepted in the atmospheric physics community that ionized aerosols, that is to say electrically charged aerosols, will nucleate and grow more aggressively to become cloud condensation nuclei (CCN) and beyond. CCN's are aerosols with a diameter of 100 nanometers (0.1 microns) or more.

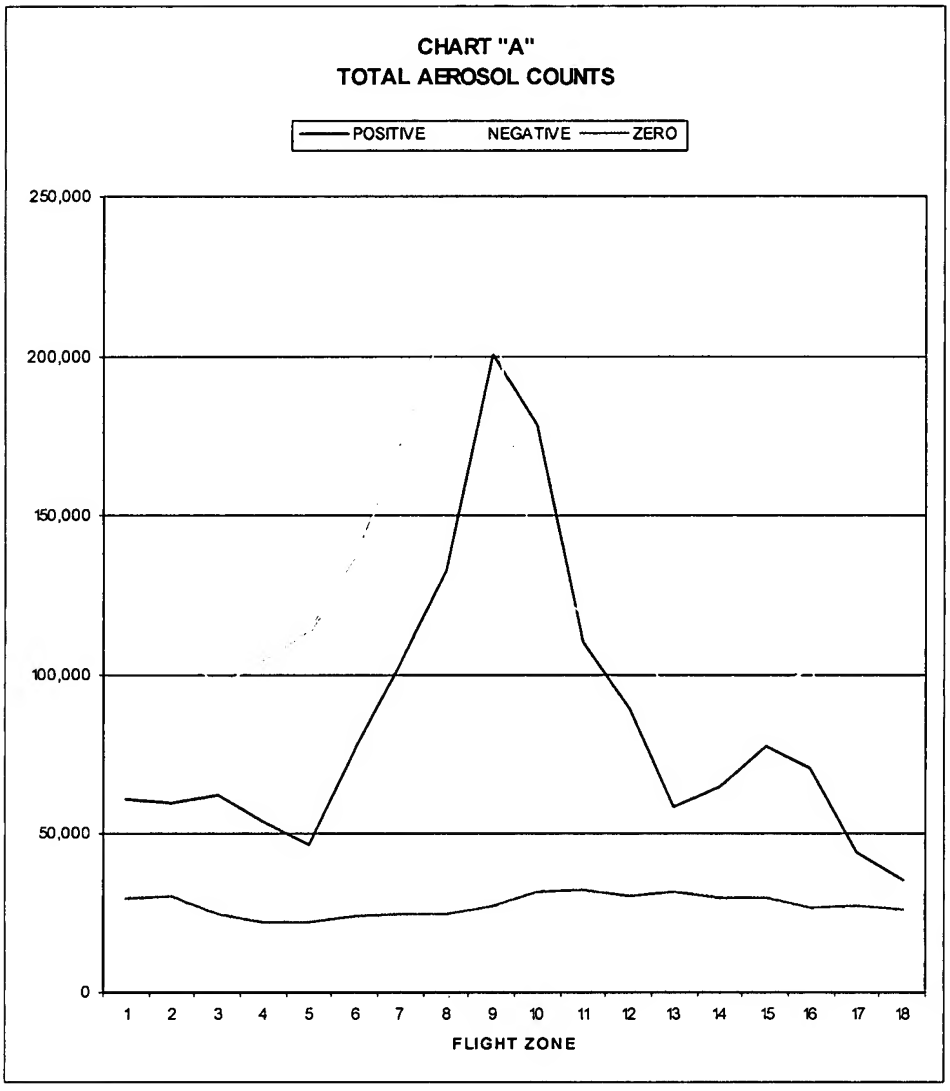
6. I have also reviewed the literature to see what has been published linking aerosol concentrations and size distributions to climate/weather changes. Even a simple search yields a plethora of articles describing this link and on-going research concerning understanding it. Attached as Exhibits A and B are two such articles from the NCAR Earth & Sun Systems Laboratory and NASA, and Exhibit C is a list of presentations at a recent American Meteorological Society Conference (2007) on the "Impact of Aerosols on Weather and Climate."

7. Ionogenics is conducting an on-going project in Laredo, Texas, with an ionization antenna such as is described and claimed in the '565 application operating on certain, selected days in order to determine what, if any effect, it has on aerosol size distribution. The antenna can be run in either positive or negative voltage mode. As claimed in the '565 application, the antenna is charged with direct current.

8. In order to measure aerosol size distribution, flights are made using a Piper Comanche 260 equipped with a Grimm Technologies 1.109 optical spectrometer, which records particle counts per liter for particles ranging from 0.250-32 microns, which is a size range from 2.5 times the diameter of a cloud condensation nuclei to 320 times that size. The 1.109 spectrometer collects data for aerosol counts in 32 channels, each one of which counts aerosols of different sizes. Readings are taken every six seconds and the 32 channels are consolidated into four groups to classify aerosols as Small (0.000 to 0.280 microns), Medium (0.281 to 0.350 microns), Large (0.351 to 0.800 microns) or Giant (0.801 to 32 microns).

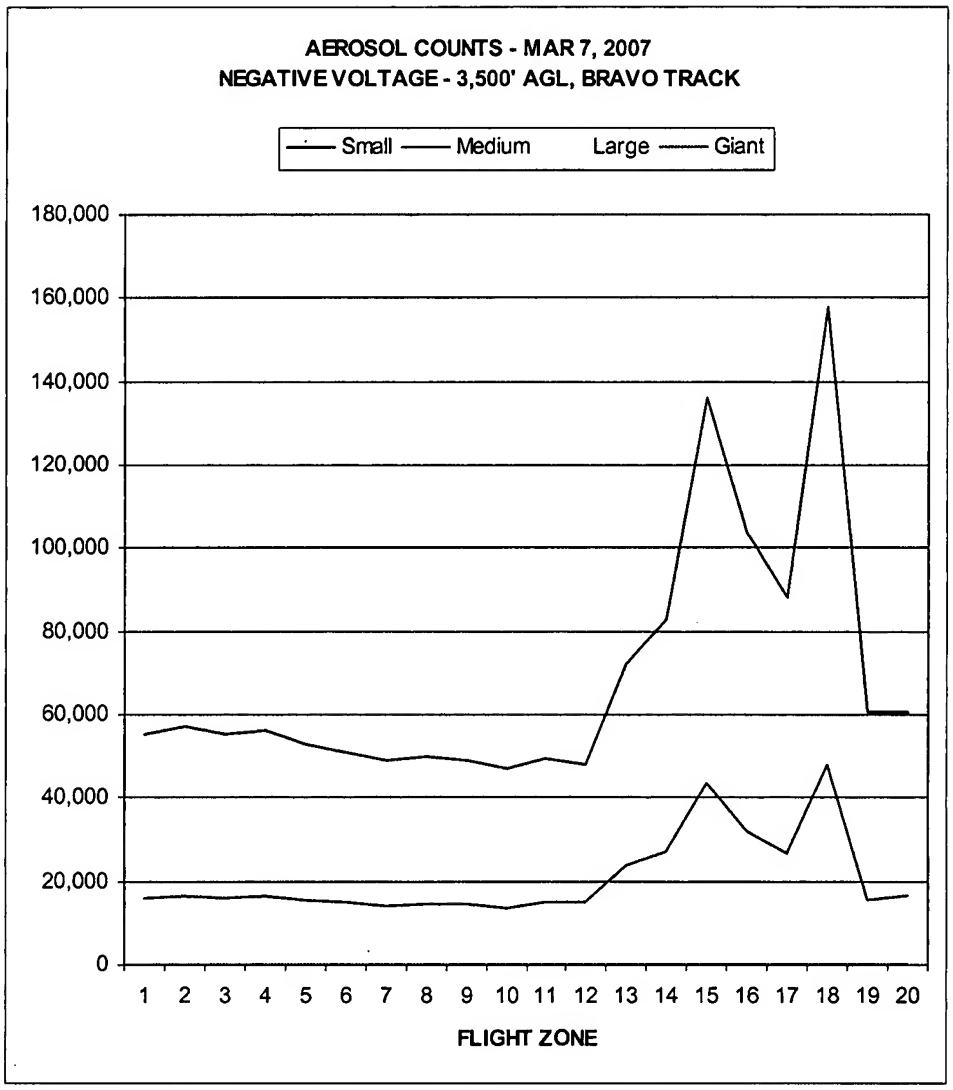
9. There are two types of flight patterns used in our experiments to date: Flight Plan Alpha and Bravo. Flight Plan Alpha has 9 flight zones, each approximately 10 nautical miles long. Flight Plan Alpha starts at a point approximately 50 nautical miles north-north-west (NNW) of the station, which is also designated as the beginning of flight zone 1. The aircraft then reaches the station at the end of flight zone 5, and continues in the same heading, south-south-east (SSE), for another 40 miles, until it reaches the end of flight zone 9. The airplane then changes altitude and, starting at the beginning of flight zone 10 (same coordinates as the end of flight zone 9), heads back along the same track, roughly from SSE to NNW, going over the station at the end of flight zone 13, and reaching the end of flight zone 18, which is the end of the measurement track. The end of the measurement flight has approximately the same coordinates as the starting coordinates. The altitudes for Flight Plan Alpha are 3,000 feet above ground level (AGL) on the out going flight and 1,500 feet AGL on the return. The 3,000 foot level is particularly interesting because that is the approximate altitude of the base of precipitation producing clouds, Flight Plan Alpha's objective was to detect if there was an aerosol size distribution pattern present in the area of influence when the ionization antenna was operating and if this pattern disappeared when the station is shut down.

10. The following Chart "A" shows the results of a test illustrating a difference in total particle counts for the use of positive, negative and zero voltage to the claimed ionization antenna using a Flight Plan Alpha flight. The measurement flights took place on April 7, 2006 (positive charge, navy blue line), April 14, 2006 (negative charge, yellow line) and April 30 of that same year (zero - antenna off, light blue line). As is evident, either a positive or negative charge on the ionization antenna has a significant effect on the number of particles as compared with the number of particles when the antenna was not operating.



11. Flight Plan Bravo starts exactly like Flight Plan Alpha, although the run was expanded from 90 miles to 120 miles. The aircraft starts at flight zone 1 at an altitude of 3,500 feet AGL and proceeds to the station (end of flight zone 6), then to the end of flight zone 12, thus covering the continental ionized sector. After that, the airplane changes heading to go straight east, toward the coast traversing the continental non-ionized sector. After about 70 nautical miles, it reaches the coast of the Gulf of Mexico at the end of flight zone 19. The plane then turns north to follow the coastline, about 2 miles off the shore, for about 12 miles measuring the maritime sector, to the end of flight zone 20. The objective of Flight Plan Bravo is to compare the aerosol distribution over the sector affected by the ionization antenna (flight zones 1 through 12) to the sector not so affected (flight zones 13 through 19) and to the maritime (or coastline) sector (flight zone 20).

12. The chart below, titled "Aerosol Counts – Mar 7, 2007, Negative Voltage – 3,500' AGL - Bravo Track", shows the aerosol counts for three distinct sectors from a Bravo Flight Plan flight. The continental ionized atmosphere sector is comprised of flight zones 1 through 12, while flight segments 13-19 are the continental non-ionized zone. Flight zone 20 is the maritime, non-ionized zone. The chart clearly shows that a continental ionized atmosphere has a much closer resemblance to oceanic atmosphere than to continental, non-ionized atmosphere. The ionized zone clearly has a modified level of aerosols because of the proximity to the charged ionization antenna.



13. Based upon this compilation of actual field measurements and data, it is evident that the use of an ionization antenna as described and claimed in the '565 application has a significant effect on changing the aerosol size distribution and concentration in the atmosphere.

14. Given the results shown above which establish clearly that the ionization antenna affects aerosol size distribution and concentration, and based on the multiple papers, articles, presentations and discussions, which together comprise scientific literature that overwhelmingly shows wide acceptance of the fact that there is a mechanism linking aerosol size concentration and distribution and weather and/or climate change, it is clear that there is a definite link between the operation of the ionization antenna and climate and weather modification.

15. I hereby declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful, false

statements and the like so made are punishable by fine or imprisonment, or both under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

7/24/07
Date

Phillip Kauffman

EXHIBIT A

The role of aerosols in climate and weather

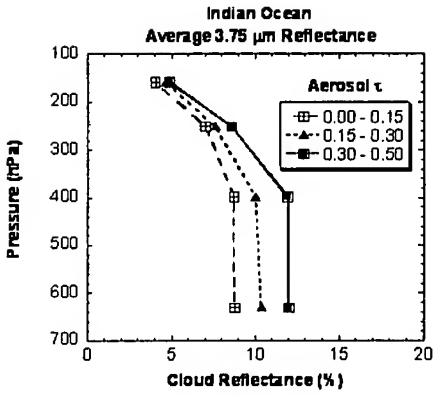
Whereas in the past, meteorology and climatology were separate fields, be it only because of disparate time (and length scales as well), it appears today that the two fields are strongly coupled, not only as the climate gives the boundaries for investigating the weather, but also because localized events can influence the larger climatological scales. The specific items on which ESSL scientists focused in this year are related to **the role of aerosols in climate and weather, to the coupling of eco-systems**, biochemistry and climate, to climate change, climate variability and extreme weather such as hurricanes, to interactions of the water cycle with climate and weather, to the impacts of climate and weather on society and ecosystems and finally to megacities and the effects of urbanization; the latter priority is a highlight for NCAR and concerns the international multi-agency field campaign that took place in Mexico city and combined interactive modeling as well. The laboratory highlights are related to **the role of aerosols**, to the regional carbon cycle, to a numerical simulation of turbulence, to landfall of hurricanes, to the global and regional water cycles and to polar climate.

Exploring the role of aerosols (formerly Bioemissions and aerosol nucleation)

In order to reduce the uncertainty of the role of aerosols in climate and weather, ESSL scientists are conducting both experimental and modeling studies of aerosol formation, composition, and impacts on climate.

ACD scientists designed and conducted the Niwot Ridge 2006 biogenic particle production and

growth study. New particle production and growth has been observed at several remote sites and has been associated with biogenic emissions of volatile organic compounds. Previous studies in the U.S. have only considered a few biogenic VOC and have had little or no information on aerosol chemical composition. The processes controlling particle production, and even the compounds responsible, are not well understood. ACD scientists collaborated with Birgit Wehner (Institute for Tropospheric Research – Liepzig, Germany) to study particle formation and growth at the University of Colorado Mountain Research Station on Niwot Ridge. Particle production and growth events were observed during conditions that brought clean continental air to the site.



Average 3.75 m m cloud reflectance binned as a function of aerosol optical depth, over the Indian Ocean for February – March 2003-2005. In the lower and middle troposphere, cloud reflectance increases as aerosol optical depth increases, which is a quantitative measurement of the aerosol indirect effect. In contrast, small effects are observed in the upper troposphere.

High resolution figure

ACD scientists are also working with Jana Milford and Detlev Helmig (U. Colorado) to investigate the contribution of biogenic VOC emissions to secondary organic aerosols (SOA) in the U.S. Initial results indicate that sesquiterpenes, monoterpenes, and isoprene all make a significant contribution to regional SOA production.

Another group of ACD scientists are working to understand the impacts of urban emissions on regional air quality through its modification of aerosol physico-chemical properties. This group specifically focuses its efforts on "ultrafine particles," those smaller than 100 nm in diameter whose impacts span all scales from local to regional and global. In March 2006, as part of the MILAGRO campaign, the ACD scientists and collaborators from the University of Minnesota, the Georgia Institute of Technology, the University of Colorado, and the Lawrence Berkeley National Laboratories deployed a suite of instruments to study aerosol formation and growth at the "T1" ground-based site NE northeast of Mexico City during the MILAGRO campaign. These activities followed the first measurements of ultrafine aerosol size distributions in the Mexico City Metropolitan Area, performed by the group in 2003, where they found that new particle formation events occur intensely and frequently both inside and outside of the metropolitan area. The preliminary results from MILAGRO show that, once again, new particle

formation and subsequent condensational growth occur frequently outside of Mexico City, and are often the dominant processes affecting number concentrations in that area. We also found that these newly formed particles consisted of a complex mixture of both organic and inorganic compounds.

A new facility for investigating biogenic SOA formation and growth was developed by ACD staff in the new NCAR Foothills ACD Laboratory and was successfully used to generate particle formation and growth from vegetation emissions. ACD scientists used this facility to conduct initial studies to demonstrate the utility of the facility. The results show that the mixture of compounds emitted from a plant result in SOA production and growth that cannot be explained by observations of the oxidation of individual compounds. A publication describing the facility and initial results is in review.

In a continuing investigation by ACD scientists, the MOZART and the CAM models have been used to investigate the radiative forcing of ozone and carbon aerosols from wildfires in Alaska and Canada. Some of these results have been incorporated into an exhaustive study of the impact of biomass burning on the boreal forest. This work shows that despite the release of large amounts of carbon dioxide, aerosols and other trace species into the atmosphere by fires, the ability of fire to change surface albedo dominates the net climactic affect of fires, leading to cooling.

Aerosol indirect effects, i.e. the manner in which changes in aerosol loading influence the reflectivity, lifetime, and precipitation characteristics of clouds, is recognized as an important uncertainty in global climate models. Quantification of these effects as a function of altitude, however, has not been well established. ACD scientists have calculated changes in cloud reflectivity as aerosol loading increases over the Indian Ocean in collaboration with Andy Heymsfield (MMM/NCAR) and Detlef Muller and Patric Seifert of the Leibniz Institute for Tropospheric Research in Leipzig, Germany. Their study utilized satellite observations of aerosol loading and visible and infrared radiances as measured by the Moderate Resolution Imaging Spectroradiometer (MODIS) experiment. Since the MODIS experiment can determine cloud top pressure and temperature, it was possible to quantify aerosol indirect effects as a function of altitude and cloud phase (i.e. liquid droplets and ice crystals). Figure 1 shows cloud reflectivity as a function of aerosol optical depth derived from the MODIS data, demonstrating an increase in reflectivity for higher aerosol optical depth (i.e. a direct measure of the aerosol indirect effect). The measured reflectivity changes are largest in the lower and middle

troposphere (corresponding to the region where liquid droplets are present) and very small in the upper troposphere (corresponding to the region where ice crystals are present). Ongoing work is aimed at extending these observations over larger regions of the globe.

Plans for FY2007 include analysis of the measurements from the Niwot Ridge and MIRAGE studies and continued work in the field and in the lab on SOA formation, composition, and growth. Also, the work evaluating aerosol indirect effect will be extended to include larger regions of the atmosphere. This work is funded by NSF/NCAR, NSF/Biocompexity, and DOE.

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Director's Message | Contents | Discoveries | ESSL Research Catalog

EXHIBIT B

NASA Facts ONLINE

FS-1996-08-11-LaRC
August 1996

Atmospheric Aerosols: What Are They, and Why Are They So Important?

Aerosols are minute particles suspended in the atmosphere. When these particles are sufficiently large, we notice their presence as they scatter and absorb sunlight. Their scattering of sunlight can reduce visibility (haze) and redden sunrises and sunsets.

Aerosols interact both directly and indirectly with the Earth's radiation budget and climate. As a direct effect, the aerosols scatter sunlight directly back into space. As an indirect effect, aerosols in the lower atmosphere can modify the size of cloud particles, changing how the clouds reflect and absorb sunlight, thereby affecting the Earth's energy budget.

Aerosols also can act as sites for chemical reactions to take place (heterogeneous chemistry). The most significant of these reactions are those that lead to the destruction of stratospheric ozone. During winter in the polar regions, aerosols grow to form polar stratospheric clouds. The large surface areas of these cloud particles provide sites for chemical reactions to take place. These reactions lead to the formation of large amounts of reactive chlorine and, ultimately, to the destruction of ozone in the stratosphere. Evidence now exists that shows similar changes in stratospheric ozone concentrations occur after major volcanic eruptions, like Mt. Pinatubo in 1991, where tons of volcanic aerosols are blown into the atmosphere (Fig. 1).

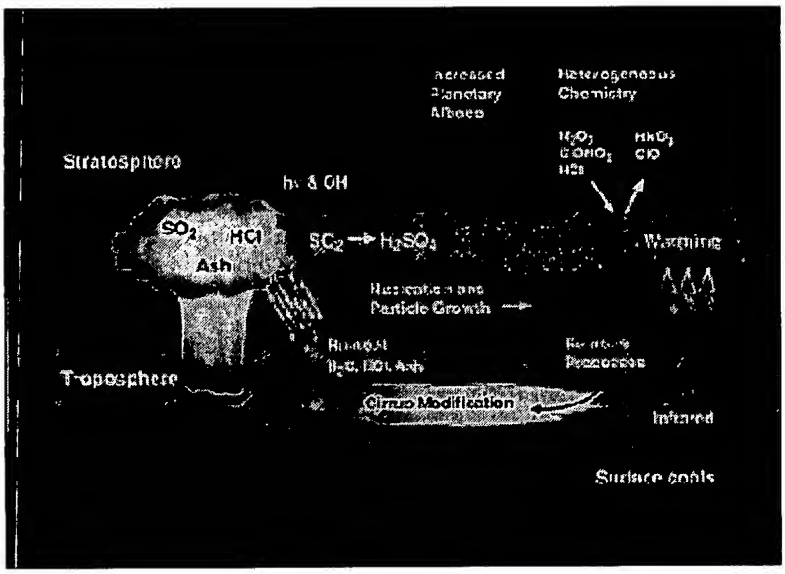


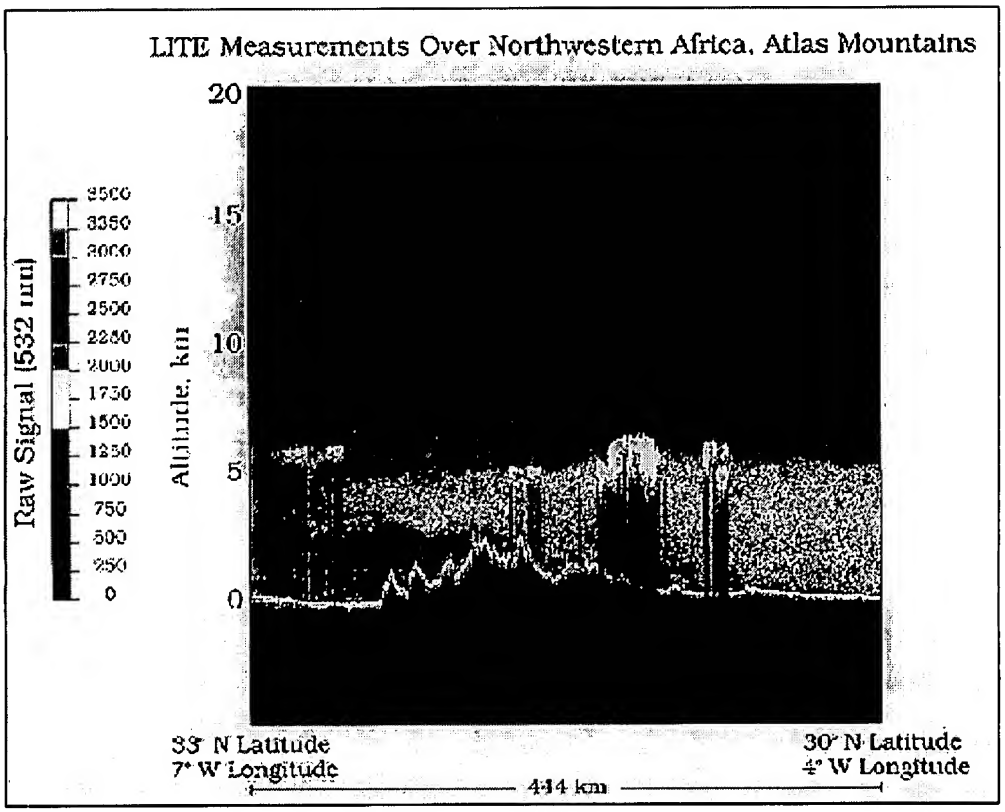
Fig. 1 The dispersal of volcanic aerosols has a drastic effect on the Earth's atmosphere. Following an eruption, large amounts of sulphur dioxide (SO2), hydrochloric acid (HCL) and ash are spewed into the Earth's stratosphere. Hydrochloric acid, in most cases, condenses with water vapor and is rained out of the volcanic cloud formation. Sulphur dioxide from the cloud is transformed into sulphuric acid (H2SO4). The sulphuric acid quickly condenses, producing aerosol particles which linger in the atmosphere for long periods of time. The interaction of chemicals on the surface of aerosols, known as heterogeneous chemistry, and the tendency of aerosols to increase levels of chlorine which can react with nitrogen in the stratosphere, is a prime contributor to stratospheric ozone destruction.

Volcanic Aerosol

Three types of aerosols significantly affect the Earth's climate. The first is the volcanic aerosol layer which forms in the stratosphere after major volcanic eruptions like Mt. Pinatubo. The dominant aerosol layer is actually formed by sulfur dioxide gas which is converted to droplets of sulfuric acid in the stratosphere over the course of a week to several months after the eruption (Fig. 1). Winds in the stratosphere spread the aerosols until they practically cover the globe. Once formed, these aerosols stay in the stratosphere for about two years. They reflect sunlight, reducing the amount of energy reaching the lower atmosphere and the Earth's surface, cooling them. The relative coolness of 1993 is thought to have been a response to the stratospheric aerosol layer that was produced by the Mt. Pinatubo eruption. In 1995, though several years had passed since the Mt. Pinatubo eruption, remnants of the layer remained in the atmosphere. Data from satellites such as the NASA Langley Stratospheric Aerosol and Gas Experiment II **(SAGE II)** have enabled scientists to better understand the effects of volcanic aerosols on our atmosphere.

Desert Dust

The second type of aerosol that may have a significant effect on climate is desert dust. Pictures from weather satellites often reveal dust veils streaming out over the Atlantic Ocean from the deserts of North Africa. Fallout from these layers has been observed at various locations on the American continent. Similar veils of dust stream off deserts on the Asian continent. The September 1994 Lidar In-space Technology Experiment **(LITE)**, aboard the space shuttle Discovery (STS-64), measured large quantities of desert dust in the lower atmosphere over Africa (Fig. 2). The particles in these dust plumes are minute grains of dirt blown from the desert surface. They are relatively large for atmospheric aerosols and would normally fall out of the atmosphere after a short flight if they were not blown to relatively high altitudes (15,000 ft. and higher) by intense dust storms.



Because the dust is composed of minerals, the particles absorb sunlight as well as scatter it. Through absorption of sunlight, the dust particles warm the layer of the atmosphere where they reside. This warmer air is believed to inhibit the formation of storm clouds. Through the suppression of storm clouds and their consequent rain, the dust veil is believed to further desert expansion.

Recent observations of some clouds indicate that they may be absorbing more sunlight than was thought possible. Because of their ability to absorb sunlight, and their transport over large distances, desert aerosols may be the culprit for this additional absorption of sunlight by some clouds.

Human-Made Aerosol

The third type of aerosol comes from human activities. While a large fraction of human-made aerosols come in the form of smoke from burning tropical forests, the major component comes in the form of sulfate aerosols created by the burning of coal and oil. The concentration of human-made sulfate aerosols in the atmosphere has grown rapidly since the start of the industrial revolution. At current production levels, human-made sulfate aerosols are thought to outweigh the naturally produced sulfate aerosols. The concentration of aerosols is highest in the northern hemisphere where industrial activity is centered. The sulfate aerosols absorb no sunlight but they reflect it, thereby reducing the amount of sunlight reaching the Earth's surface. Sulfate aerosols are believed to survive in the atmosphere for about 3-5 days.

The sulfate aerosols also enter clouds where they cause the number of cloud droplets to increase but make the droplet sizes smaller. The net effect is to make the clouds reflect more sunlight than they would without the presence of the sulfate aerosols. Pollution from the stacks of ships at sea has been seen to modify the low-lying clouds above them. These changes in the cloud droplets, due to the sulfate aerosols from the ships, have been seen in pictures from weather satellites as a track through a layer of clouds. In addition to making the clouds more reflective, it is also believed that the additional aerosols

cause polluted clouds to last longer and reflect more sunlight than non-polluted clouds.

Climatic Effects of Aerosols

The additional reflection caused by pollution aerosols is expected to have an effect on the climate comparable in magnitude to that of increasing concentrations of atmospheric gases. The effect of the aerosols, however, will be opposite to the effect of the increasing atmospheric trace gases - cooling instead of warming the atmosphere.

The warming effect of the greenhouse gases is expected to take place everywhere, but the cooling effect of the pollution aerosols will be somewhat regionally dependent, near and downwind of industrial areas. No one knows what the outcome will be of atmospheric warming in some regions and cooling in others. Climate models are still too primitive to provide reliable insight into the possible outcome. Current observations of the buildup are available only for a few locations around the globe and these observations are fragmentary.

Understanding how much sulfur-based pollution is present in the atmosphere is important for understanding the effectiveness of current sulfur dioxide pollution control strategies.

The Removal of Aerosols

It is believed that much of the removal of atmospheric aerosols occurs in the vicinity of large weather systems and high altitude jet streams, where the stratosphere and the lower atmosphere become intertwined and exchange air with each other. In such regions, many pollutant gases in the troposphere can be injected in the stratosphere, affecting the chemistry of the stratosphere. Likewise, in such regions, the ozone in the stratosphere is brought down to the lower atmosphere where it reacts with the pollutant rich air, possibly forming new types of pollution aerosols.

Aerosols As Atmospheric Tracers

Aerosol measurements can also be used as tracers to study how the Earth's atmosphere moves. Because aerosols change their characteristics very slowly, they make much better tracers for atmospheric motions than a chemical species that may vary its concentration through chemical reactions. Aerosols have been used to study the dynamics of the polar regions, stratospheric transport from low to high latitudes, and the exchange of air between the troposphere and stratosphere.

Future NASA Aerosol Studies

NASA's ongoing Atmospheric Effects of Aviation Project (AEAP) has measured emissions from the engines of several commercial and research aircraft. Jet engine emissions have been shown to affect the concentrations of atmospheric water vapor and aerosols, and they may affect how clouds form and the concentrations of atmospheric ozone. Few actual measurements of their effects have been made, however.

In the spring of 1996, the Subsonic Aircraft Contrail and Cloud Effects Special Study (SUCCESS) focused on subsonic aircraft contrails and the impact of the aerosols in those contrails on cirrus clouds and atmospheric chemistry. Researchers have determined that aircraft contrails can prolong the presence of high altitude cirrus clouds while also decreasing the size of the ice crystals that make up the clouds.Studies like SUCCESS and AEAP will be ongoing as scientists continue to try to understand how aerosols affect our atmosphere and climate.

For more information, please contact:

NASA Langley Research Center
Office of Public Affairs
Mail Stop 115
Hampton, VA 23681-0001
(757) 864-6124

OR

Visit NASA Langley's Atmospheric Sciences Division (ASD) Homepage

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EXHIBIT C

AMS Forum: Climate Change Manifested by Changes in Weather

Session 6

Impacts of Aerosols on Weather and Climate

1:30 PM 6.1 Aerosol-Climate Research: The Kaufman-MODIS Era
V. Ramanathan, Scripps Institution of Oceanography, San Diego, CA

2:00 PM 6.2 Wind and water supply reduction by aerosol particles
Mark Z. Jacobson, Stanford University, Stanford, CA; and Y. J. Kaufman

2:15 PM 6.3 The impacts of aerosols on Asian summer monsoon rainfall and circulation
Kyu-Myong Kim, University of Maryland Baltimore County, Greenbelt, MD; and W. K. M. Lau

2:30 PM 6.4 "Weekend effect" for precipitation over eastern U.S.: Evidence for midweek intensification by pollution and historical evolution
Thomas L. Bell, NASA/GSFC, Greenbelt, MD; and K. M. Kim, D. Rosenfeld, J. M. Yoo, M. I. Lee, and M. Hahnenberger

2:45 PM 6.5 Global aerosol climatology in the EOS satellite era: Sources, transport, and atmospheric effects using the MODIS satellite data and the GOCART global model
Mian Chin, NASA/GSFC, Greenbelt, MD, MD; and L. A. Remer, T. Diehl, and H. Yu

3:00 PM Coffee Break

3:30 PM 6.6 MODIS aerosol observations used to constrain dust distributions and lifecycle in the NASA GEOS-5 model
Peter R. Colarco, NASA/GSFC, Greenbelt, MD; and E. Nowottnick and A. Da Silva

3:45 PM 6.7 How 3D science can help to correctly interpret satellite data on aerosol-cloud interaction
Alexander Marshak, NASA/GSFC, Greenbelt, MD; and G. Wen, T. Varnai, and R. F. Cahalan

4:00 PM 6.8 Possibilities and Limitations of Current-Generation Satellite Aerosol Passive Remote Sensing, and Hopes for the Future
Ralph A. Kahn, JPL/Caltech, Pasadena, CA; and J. Martonchik, D. Diner, B. Gaitley, M. Garay, O. Kalashnikova, D. Nelson, K. Yau, and T. M. Team

4:15 PM 6.9 Urban Aerosol Impact on Surface Energy and Hydrologic Cycles
Menglin Jin, University of Maryland, College Park, MD; and J. M. Shepherd

4:30 PM 6.10 Stratocumulus sensitivity to aerosols and dynamics PDF
Guillaume Sadler Mauger, SIO/Univ. Of California, La Jolla, CA; and J. R. Norris

4:45 PM 6.11 An aerosol climatology from MODIS observations and products
Lorraine A. Remer, NASA/GSFC, Greenbelt, MD; and R. Kleidman and Y. Kaufman

5:00 PM 6.12 Remote sensing of the aerosol-cloud boundary
Jens Redemann, Bay Area Environmental Research Institute, Ventura, CA; and Q. Zhang, P. B. Russell, P. Pilewskie, J. Livingston, B. Schmid, L. A. Remer, and R. A. Kahn

5:15 PM 6.13 Aerosol retrievals using airborne lidar and MODIS measurements PDF
Richard A. Ferrare, NASA/LaRC, Hampton, VA; and E. V. Browell, Y. Kaufman, J. F. Leon, M. Chin, C. Butler, V. G. Brackett, S. Burton, G. Chen, A. Clarke, P. B. Russell, J. Redemann, and L. A. Remer

5:30 6.14 The Impact of Aerosols on the Color and Brightness of the Sun and Sky PDF

PM **Stanley David Gedzelman**, The City College of New York, New York, NY

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